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The effect of sodium-glucose linked transporter 2 inhibitor and glucagon-like peptide-1 receptor agonist on weight and blood pressure control in an obese diabetic patient: a case report

Zekiye Nur Haktanıyan, Artuner Varlıbaş, Aydın Çifci

Department of Internal Medicine, Faculty of Medicine, Kırıkkale University, Kırıkkale, Turkiye

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ABSTRACT

Obesity and diabetes are two closely related and often co-occurring clinical conditions that are difficult to treat and full of uncertainties. Moreover, they are often accompanied by another disease that is just as difficult to treat: hypertension. Although the picture may seem complex, pessimistic, and requiring a lot of medication, it is possible to develop a holistic strategy. With the case we have presented, we would like to share our treatment plan focused on the treatment of diabetes and its results and draw attention to the effects of sodium-glucose linked transporter 2 inhibitor, and glucagon-like peptide-1 receptor agonist therapies on weight loss and blood pressure control.

Keywords: Sodium-glucose linked transporter 2 inhibitor, SGLT2-i, glucagon-like peptide-1 receptor agonist, GLP-1RA, type 2 diabetes, hypertension

INTRODUCTION

Obesity, hypertension, and diabetes mellitus are commonly seen in society, and the frequency of coexistence of these conditions is increasing.[1] Considering the coexistence of these conditions and their effects on each other, considering their comorbidities as a whole in the management of patients will be beneficial in terms of treatment response. As is well known, obese patients can benefit from the use of sodium-glucose linked transporter 2 inhibitor (SGLT2-i), and glucagon-like peptide-1 receptor agonist (GLP-1 RA) group drugs in the treatment of type 2 diabetes mellitus due to their ability to aid in weight loss.[2] Weight loss in these patients is also effective in terms of effective control of blood pressure.

We aimed to emphasize the versatility of hypertension treatment by talking about the effect of blood glucose and weight control on blood pressure regulation in our morbidly obese and diabetic hypertension patients.

CASE

A 51-year-old woman was admitted to our clinic with irregular blood glucose and blood pressure monitoring despite medication use and hypoglycemia attacks. Her medical history included type 2 diabetes mellitus, hypertension, hyperlipidemia, and chronic kidney disease. He was regularly taking metformin 2x1000 mg/day, insulin glargine 1x60 U/day, insulin aspart 3x30 U/day, atorvastatin 20 mg/day, irbesartan/amlodipine/hydrochlorothiazide 300/10/12.5 mg/day, and metoprolol 50 mg/day as antihypertensive treatment. The patient was 130 kilograms and 162 centimeters at admission. Body-mass index (BMI) was calculated as 49.5 kg/m^2. Blood pressure was measured as 160/90 mmHg. Physical examination revealed no abnormal findings except anthropometric measurements consistent with morbid obesity. Laboratory tests revealed HbA1c 9.4%, eGFR 57 ml/min, fasting blood glucose 295 mg/dl. Other laboratory test results were within the normal range. When the patient's home blood glucose monitoring form was examined, hypoglycemic values of 50–60 mg/dl and extreme values of 400–500 mg/dl were observed. In blood pressure monitoring, systolic arterial blood pressure was measured at values as high as 180 mmHg.

The patient's medication was reorganized by targeting weight loss, blood glucose regulation, blood pressure regulation, and nephroprotection. It was also learned that the patient, who had been using quadruple insulin therapy for many years, was non-compliant with his treatment because he was fatigued of multiple injections during the day, skipped meals, and had irregular insulin doses. Insulin treatment was planned to be reduced to two injections per day. Pancreatic lipase inhibitors SGLT2-i and dipeptidyl peptidaz-4 inhibitor (DPP-4i)were

Corresponding Author: Zekiye Nur Haktanıyan, zekiyehaktaniyan@gmail.com

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added to the drug treatment, and the treatment was changed to metformin/sitagliptin 2x1000/50 mg/day, dapagliflozin 10 mg/day, insulin degludec+aspart 2x40 U/day, orlistat 2x120 mg/day. Diet and insulin use training was given to the patient. The diet recommended to the patient was a Mediterranean diet based on salt and carbohydrate restriction, targeting negative energy metabolism at 500 kcal per day. The diet also aimed to avoid skipping meals and to place them at certain times. Lifestyle change recommendations were made. Antihypertensive and antilipidemic treatment was continued with the same drugs, and the patient was followed up.

At the end of the 1st week, the patient had a weight loss of 6 kg; fasting and postprandial blood sugars were between 120-170 and 140-230 mg/dl, respectively. Insulin degludec+aspart was reduced to 2x35 U/day. At the end of the 1st month, there was a total weight loss of 11 kg, and blood glucose measurements were lower than the 1st week. In addition, arterial blood pressure was measured as 150-160 mmHg at most, which had previously been 180 mmHg intermittently. Insulin degludec+aspart 2x30 U/day was administered. At the end of the 2nd month, the patient had a total weight loss of 17 kg, and fasting blood glucose values decreased to around 100-110 mg/dl. Insulin degludec+aspart was reduced to 2x25 U/day. At the end of the 3rd month, total weight loss was 19 kg compared to baseline. Final BMI was calculated as 42.2 kg/m^2. HbA1c was 8.2%. No adverse changes in laboratory parameters were observed during this whole period. A new treatment modification was planned for the patient whose weight loss slowed down despite diet, lifestyle change, and the new treatment arrangement. GLP-1 RA was added to the patient's treatment, DPP-4i was stopped, and the insulin dose of the patient whose blood sugars were regulated was reduced to once a day, and the patient was switched to basal insulin. Metformin 2x1000 mg/day, dapagliflozin 10 mg/day, U300 insulin glargine 40 U/day, orlistat 2x120 mg/day, and exenatide 2x5 mcg/day were prescribed. At the end of the 4th month, the patient lost 7 kg compared to the 3rd month, and the U300 insulin glargine dose was decreased to 30 U/day after blood glucose levels were regulated. The patient's arterial blood pressure was found to be regulated in blood pressure follow-up, and the patient's 4th antihypertensive drug, beta blocker, was discontinued.

At the end of the 6th month, the patient lost 9 kg compared to the 4th month, and HbA1c was measured as 7.8%. No negative change was observed in other laboratory parameters. U300 insulin glargine was reduced to 10 U. The maximum systolic arterial pressure was measured as 140 mmHg in blood pressure monitoring. At the end of the 8th month, the patient weighed 90 kg. BMI was 34.3 kg/m^2. No hypo-hyperglycemia or other adverse side effects were observed, and insulin treatment was discontinued after blood glucose monitoring. As the highest systolic blood pressure values of 120-130 mmHg were observed in blood pressure follow-up, the thiazide treatment of the patient, who was currently using irbesartan/amlodipine/hydrochlorothiazide 300/10/12.5 mg/day as antihypertensive, was discontinued. In the following months, as the patient's blood pressure follow-ups remained stable, the dose of amlodipine was halved, and the patient was continued to be followed up with dual antihypertensive treatment. During follow-up, arterial blood pressure and blood glucose levels were regulated, there was no hypo-hyperglycemia, and no abnormal changes were observed in laboratory parameters.

DISCUSSION

It is noteworthy that weight loss, blood pressure, and blood sugar regulation were achieved in connection with the change in treatment in our patient. While blood pressure control and blood sugar regulation were achieved, the need for antihypertensive drugs and insulin decreased. Therefore, evaluating the comorbidities of the patients together will be beneficial in treatment response, and such treatment approaches may reduce the need for bariatric surgery in patients, especially in the morbidly obese patient group.[3]

Although SGLT2-i and GLP-1 RA group drugs are antidiabetic, they are also effective on hypertension.[4] SGLT2-i causes glucosuria by inhibiting the reabsorption of glucose in the kidney.[5] Glucose passing into the urine provides diuresis and natriuresis with an osmotic effect and enables SGLT2-i to exert diuretic effect.[6,7] In terms of GLP-1 RA, improvement in endothelial function with receptor activation, provision of natriuresis, and increase in vasodilation may explain this activity.[8] Independently, suppression of sympathetic nervous system activity may also play a role in blood pressure reduction.[9] This group of drugs has been a new research topic in the literature in terms of antihypertensive efficacy. Studies and some meta-analyses suggest that the combined use of these drugs may be effective in some patients.[10]

CONCUSION

As in our case, control of diseases other than hypertension is an important part of antihypertensive treatment in patients with comorbidities. Treatment management should be patient-specific, and the patient should be considered as a whole. Each drug class has its own additional properties other than lowering blood pressure, and if these properties are used effectively, it is possible to see extraordinary responses. If obesity is also present in patients with type 2 diabetes mellitus, SGLT2-i and GLP-1 RA group drugs may be considered in the foreground. In addition, more studies are needed to evaluate the antihypertensive effects of these drugs in both diabetic and non-diabetic patients.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Jobe M, Mactaggart I, Bell S, et al. Prevalence of hypertension, diabetes, obesity, multimorbidity, and related risk factors among adult Gambians: a cross-sectional nationwide study. *The Lancet Global Health*. 2024;12(1):e55-e65.

2. Ma H, Lin Y-H, Dai L-Z, Lin C-S, Huang Y, Liu S-Y. Efficacy and safety of GLP-1 receptor agonists versus SGLT-2 inhibitors in overweight/obese patients with or without diabetes mellitus: a systematic review and network meta-analysis. *BMJ Open*. 2023;13(3):e061807.
3. Shariq OA, McKenzie TJ. Obesity-related hypertension: a review of pathophysiology, management, and the role of metabolic surgery. *Gland Surgery*. 2020;9(1):80.
4. Diallo A, Carlos-Bolumbu M, Galtier F. Blood pressure-lowering effects of SGLT2 inhibitors and GLP-1 receptor agonists for preventing of cardiovascular events and death in type 2 diabetes: a systematic review and meta-analysis. *Acta Diabetologica*. 2023;60(12):1651-1662.
5. Varlibaş A, Çifci A. Management of patients with diabetes and chronic renal disease: management of patients with diabetic and chronic kidney disease. *J Transl Pract Med.* 2022;1(1):14-22.
6. Salvatore T, Galiero R, Caturano A, et al. An overview of the cardiorenal protective mechanisms of SGLT2 inhibitors. *Int J Mol Sci*. 2022;23(7):3651.
7. Tan B, Çifci A. The relationship between sodium glucose co-transporter 2 inhibitors and diabetic ketosis/infection: single center retrospective experiences. *Ankyra Med J*. 2024;3(1):1-5.
8. Goud A, Zhong J, Peters M, Brook RD, Rajagopalan S. GLP-1 agonists and blood pressure: a review of the evidence. *Curr Hypertens Rep.* 2016;18(2):16.
9. Sivertsen J, Rosenmeier J, Holst JJ, Vilsbøll T. The effect of glucagon-like peptide 1 on cardiovascular risk. *Nat Rev Cardiol.* 2012;9(4):209-222.
10. Gourdy P, Darmon P, Dievart F, Halimi J-M, Guerci B. Combining glucagon-like peptide-1 receptor agonists (GLP-1RAs) and sodium-glucose cotransporter-2 inhibitors (SGLT2is) in patients with type 2 diabetes mellitus (T2DM). *Cardiovas Diabetol.* 2023;22(1):79.